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NATIONAL DAM SAFETY PROGRAM. DORAMUS LAKE DAM (MO 20139), MISSO--ETC(U)
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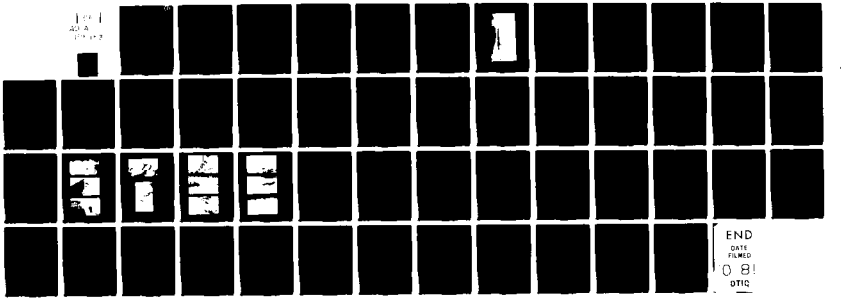

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MISSOURI
MISSOURI-KANSAS CITY BASIN

DORAMUS LAKE DAM

JACKSON COUNTY, MISSOURI

MO 20139

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY: HOSKINS-WESTERN-SONDEREGGER, INC.

FOR: STATE OF MISSOURI

SEPTEMBER, 1978

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Doramus Lake Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Doramus Lake Dam:

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood.
2) Overtopping could result in dam failure.
3) Dam failure significantly increases the hazard to loss of life downstream

SUBMITTED BY: SIGNED
Chief, Engineering Division — 2 APR 1979
Date

APPROVED BY:
Colonel, CE, District Engineer — 4 APR 1979
Date

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
DORAMUS LAKE DAM
ID. NO. MO 20139

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OP-1

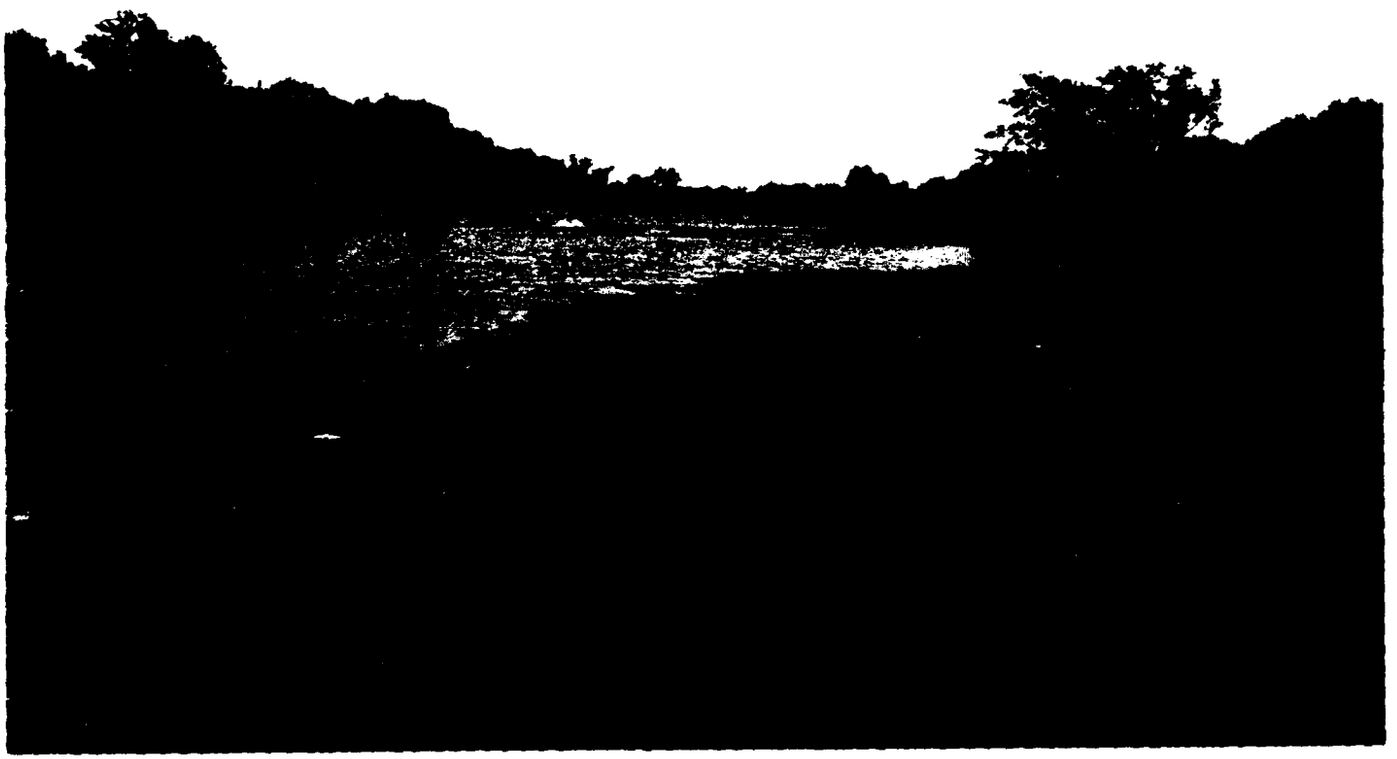


PHOTO NO. 1
OVERVIEW
LOOKING WEST TO DAM

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Doramus Lake Dam
State Located	Missouri
County Located	Jackson County
Stream	Tributary to Blue River
Date of Inspection	September 21, 1978

Doramus Lake Dam was inspected by an interdisciplinary team of engineers from Hoskins-Western-Sonderegger, Inc. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers, and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as a small size dam with a high downstream hazard potential. Failure would threaten life and property. The estimated damage zone extends 1.5 miles downstream of the dam. Within the damage zone are three to four houses, two unimproved roads and two improved roads. Also located downstream of the dam is a smaller lake.

Our inspection and evaluation indicates that in consideration of the small amount of water impounded, the large floodplain downstream and the maximum of four houses downstream, 50% of the Probable Maximum Flood is the appropriate design flood. The spillways of this dam do not meet this criteria. The spillways will pass the 100 year flood (flood having a one percent chance of being exceeded in any year) without overtopping. The spillways will pass 28% of the Probable Maximum Flood without overtopping the dam. The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These analyses should be obtained in the future.

Deficiencies visually observed by the inspection team were trees and bushes growing on both slopes of the dam, deterioration of the concrete weir in some locations, a wire fence on top of the concrete weir which could affect the operation of the principal spillway, inlet channel to secondary spillway overgrown with weeds, considerable erosion

of the principal spillway channel below the four CMP outlet pipes, exit channel from principal spillway overgrown with trees and brush, approximately 100 feet of secondary spillway channel overgrown with trees and brush, and seepage below the principal spillway outlet channel.

Several items of preventive maintenance need to be initiated by the owner. These are described in detail in the body of the report.

H. P. Hoskins

Harold P. Hoskins, P.E.
Hoskins-Western-Sonderegger, Inc.
Lincoln, Nebraska

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
DORAMUS LAKE DAM - MO 20129
JACKSON COUNTY, MISSOURI

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of Doramus Lake Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth fill originally constructed by the KC&S railroad to store water for use in steam locomotives. Topography adjacent to the site is gently rolling. Materials exposed in the surrounding slopes consist of loess or reworked loessial soils underlain by shales and limestones.

(2) The primary spillway is located on the left (south) end of the dam and consists of a weir with four 48-inch corrugated metal pipe (CMP) outlets.

(3) The secondary or emergency spillway is located on the right end of the dam and consists of four 24-inch CMP outlets.

(4) Pertinent physical data are given in Paragraph 1.3, below.

b. Location. The dam is located in the southwestern corner of Jackson County, Missouri, as shown on Plate 2. The dam and the lake formed by the dam is shown on Plate 1 in the SE 1/4 of Section 15 and the NE 1/4 of Section 22, T13S, R33W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in Paragraph 1.1c above. Based on these criteria, this dam and impoundment is in the small size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in Paragraph c above. Based on referenced guidelines, this dam is in the High Hazard Classification. The estimated damage zone extends 1.5 miles downstream of the dam. Within the damage zone are three to four houses, two improved roads and two unimproved roads. Also, located just downstream from Doramus Lake Dam is a much smaller dam.

e. Ownership. This dam is owned by Midwest Research Institute, 13100 Robinson Pike Road, Grandview, Missouri 64030.

f. Purpose of Dam. The dam forms a 9 acre ± recreational lake.

g. Design and Construction History. No design or construction records were available on the dam. It was reported that the dam was constructed 75 to 100 years ago to store water for Kansas City and Southern Railroad locomotives. The four 24-inch culverts serving as an emergency spillway on the right abutment were installed in 1960 or 1961 when the adjacent road was constructed.

h. Normal Operating Procedure. There are no controlled outlets for this dam. It was reported that the lake is spring fed and that the lake level is fairly stable. It was also reported that the spillways operate frequently but the dam has not been overtopped.

1.3 PERTINENT DATA

a. Drainage area. 184 acres (0.29 square mile).

b. Discharge at Damsite.

(1) All discharge at the damsite is over a primary spillway consisting of an uncontrolled drop-inlet type weir and set of culverts near the left abutment and through a secondary spillway consisting of a set of culverts near the right abutment.

(2) Estimated maximum flood at damsite - unknown.

(3) The primary spillway weir capacity varies from 0 c.f.s. at crest elevation of 990.0 feet to 325 c.f.s. at elevation 992.9 feet (low point on dam crest). The set of four 48" CMP culverts become the predominent control over the weir at 993.6 feet, after the dam has overtopped.

(4) The secondary spillway culvert (set of four 24" CMP) capacity varies from 0 c.f.s. at 990.0 feet to 75 c.f.s. at elevation 992.9 feet (low point on dam crest).

(5) The maximum pool elevation is 992.9 feet (low point on dam crest).

(6) The total spillway capacity at maximum pool level is 400 c.f.s.

c. Elevation (Feet Above M.S.L.).

(1) Top of dam (low point) - 992.9.

(2) Primary spillway weir crest - 990.0.
Primary spillway culverts inlet invert - 984.5.

(3) Secondary spillway culverts inlet invert - 990.0.

(4) Streambed at center line of dam - 960 ±.

(5) Maximum tailwater - unknown.

d. Reservoir.- Length of maximum pool - 1,500 feet ±.

e. Storage (Acre-feet).

(1) Top of dam - 97.

(2) Spillway crest - 70.

f. Reservoir Surface (Acres).

(1) Top of dam - 10 ±.

(2) Spillway crest - 9 ±.

g. Dam.

(1) Type - Earth embankment.

(2) Length - 450 feet ±.

(3) Height - 33 feet ±.

(4) Top width - 14 feet.

(5) Side slopes.

(a) Downstream - 2.8H on 1V (measured).

(b) Upstream - 3H on 1V (measured on exposed section).

(6) Zoning - unknown.

(7) Impervious core - unknown.

(8) Cutoff - unknown.

(9) Grout curtain - unknown.

(10) Wave protection - none.

h. Diversion and Regulation. None

i. Spillways.

(1) Primary.

(a) Type - Reinforced concrete broad-crested weir drop inlet with a set of four 48" CMP culverts.

(b) Length of weir (stepped) and crest elevation - 28 feet at 990.0 feet; plus 6 feet at 990.9 feet; plus 18 feet at 993.1 feet.

(c) Culvert invert elevation - 984.5 feet.

(2) Secondary.

(a) Type - Set of four 24" CMP culverts.

(b) Invert elevation - 990.0 feet.

j. Regulating Outlets. None.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were available for this dam.

2.2 CONSTRUCTION

No construction data were available for this dam. It was reported that the secondary spillway on the right abutment was installed in 1960 or 1961.

2.3 OPERATION

There are no controlled outlets for this structure. It was reported that the lake level remains fairly constant and that the spillways flow frequently.

2.4 EVALUATION

a. Availability. There were no engineering data available for this dam.

b. Seepage and Stability Analyses. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of Doramus Lake Dam was made on September 21, 1978. Engineers from the firm of Hoskins-Western-Sonderegger, Inc., Lincoln, Nebraska making the inspection were: Stephen Nickel, Geology and Soil Mechanics; Gordon Jamison, Hydrology and Hydraulics; Garold Ulmer, Civil Engineer; and Richard Walker, Hydrology. Specific observations are discussed below.

b. Dam. The upstream slope above the water line was found to be covered with grass. There was one tree near the center of the dam and several small trees or bushes in the vicinity of the primary spillway weir near the left abutment of the dam. There was an area of recently-placed gravel on the upstream slope between center line stations 3+25 and 3+60. This was reported to be an area where surplus gravel from another part of the property was wasted.

Portions of the downstream slope of the dam were covered with grass. At the highest section of the dam, the slope was covered by a dense growth of weeds and bushes. Several small trees were growing on the embankment near the left abutment. The density of the growth of weeds and bushes at the highest section of the embankment made it difficult to determine the condition of this section of the embankment. The remainder of the embankment appeared to be in good condition, with no slides or seepage being noted. The materials exposed on the slopes of the dam were mostly silty clay, with some gravel on parts of the upstream slope.

The abutments apparently consist of plastic silty clay, similar to that in the embankment, overlying limestone ledges alternating with beds of shale. A limestone outcrop was observed immediately upstream from the left abutment of the embankment. This area was reported to be a spring, but water was not flowing at the time of the inspection. However, the ground surface in the area was very wet. No slides were noted in the abutments. Seepage that was found is discussed under Paragraph e, below.

It was reported that there is a rock-filled infiltration pit below the downstream toe near the right abutment. This pit was constructed to receive chemical wastes and permit them to seep slowly into the soil. It is rarely used at the present, and when in use the pit is not under a pressure head. It should pose no threat to the dam.

c. Appurtenant Structures.

(1) Primary Spillway. The primary spillway consists of a weir with four 48-inch CMP outlet pipes, built at the left end of the embankment. Spillway details are shown in Appendix C. The concrete in the weir appears to be serviceable, but the surface is deteriorating in some locations. A wire fence along the top of the weir could affect the operation of the spillway. The four outlet pipes appear to be in good condition.

(2) Secondary Spillway. A secondary spillway, consisting of four 24-inch CMP culverts, passes through the embankment near the right abutment. The elevation of the inverts of these pipes is the same as the weir elevation. The inlet channel to the secondary spillway was overgrown with weeds. No other outlet works were found.

d. Reservoir Area. No wave wash, excessive erosion, or slides were observed along the shore of the reservoir.

e. Downstream Channel. The primary spillway exit channel is excavated out of the left abutment and descends that abutment at a slope of between 5 and 10%. There is considerable erosion in the channel immediately below the four CMP outlet pipes. If allowed to continue, this erosion could threaten the embankment. Limestone blocks are exposed in the eroded bottom of the exit channel. At the time of the inspection, the spillway flow (approximately 4 gallons per minute) was disappearing into voids in the limestone blocks approximately 40 to 50 feet downstream from the embankment. Seepage of the same relative magnitude was found to the right of and below the exit channel at this location. The seepage appeared to come from the exit channel rather than from the reservoir. The exit channel is relatively well defined to a point approximately 300 feet below the embankment, where the channel empties onto the left shore of the small reservoir below Doramus Lake Dam. For its entire length the exit channel is overgrown with trees and brush.

The secondary spillway exit channel is excavated out of the right abutment below the embankment and descends that abutment at a slope of between 5 and 10%. No erosion was noted in the channel. No limestone outcrops were seen. No water was flowing in the channel, and no seepage was observed. The secondary spillway exit channel is relatively well defined to a point approximately 200 feet downstream from the embankment, where the channel empties onto the right shore of the small reservoir below Doramus Lake Dam. The first 100 feet of this channel are overgrown with trees and brush. The remainder of the channel is grass.

The small reservoir downstream from Doramus Lake Dam is retained by a low dam having a single CMP outlet pipe approximately 30 inches in diameter. No emergency spillway was apparent. It was reported that this dam was overtopped in 1977. The outlet pipe appeared to be relatively new, and the embankment in the vicinity of the outlet pipe appeared to be recently constructed.

f. Downstream Hazards. Downstream hazards are described in Section 5.

3.2 EVALUATION

The erosion of the primary spillway outlet channel could lead to the potential of failure if left uncorrected. Additional studies would be required to determine the actual source of seepage below the primary spillway outlet channel and to determine the effect of this seepage on the stability of the dam. The flat side slopes on this embankment would ordinarily provide adequate safety against shear failures for a dam of this height. The heavy vegetation on the downstream slope made it impossible to fully observe the structural conditions on the slope. The trees now growing on the upstream and downstream slopes, if allowed to continue to grow, would have the potential of causing failure of the dam by piping along their roots. The weir has a potential for failure if the concrete is allowed to deteriorate.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no controlled outlet works for this dam and no regulating procedures exist.

4.2 MAINTENANCE OF DAM

Those portions of the embankment covered by grass appear to be regularly mowed. The size of the trees and brush in those areas not regularly mowed indicates that it has been several years since any vegetative control measures have been performed. The roadway on the crest of the dam has a relatively new bituminous surface.

4.3 MAINTENANCE AND OPERATING FACILITIES

No operating facilities exist at this dam.

4.4 DESCRIPTION OF WARNING SYSTEM IN EFFECT

The inspection team is not aware of any warning system at this dam.

4.5 EVALUATION

Trees and brush growing on the upstream and downstream slopes could lead to the potential of failure if not controlled.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No original or rehabilitation design data were found for this dam.

b. Experience. The drainage area, lake surface area, and elevation-storage data were developed from the U.S.G.S. Grandview Missouri-Kansas 7 1/2 minute quadrangle topographic map. The hydraulic computations for the spillways and dam overtopping discharge ratings were developed from observations and data collected in the field at the time of the field inspection.

c. Visual Observations.

(1) The left upstream corner of the R/C weir has been broken off for a width of about 1 foot and 1 foot in depth.

(2) The spillway appears to be used every time there is significant runoff.

(3) Spillway use should not endanger the dam.

d. Overtopping Potential. The spillways are too small to pass the 1/2 probable maximum flood without overtopping. The spillways will pass the 0.28 PMF without overtopping (0.0 freeboard). The spillways will pass the 24-hour 100-year frequency flood without overtopping. The 100-year frequency (1%) flood outflow discharge is approximately 80 percent of the spillway capacity. The results of the routings through the reservoir are tabulated in regards to the following conditions.

Frequency	Peak Inflow Discharge c.f.s.	Peak Outflow Discharge c.f.s.	Maximum Pool Elevation	Freeboard Top of Dam Min. Elev. 992.9	Time Dam Overtopping Hrs.
100-Year	410	320	992.5	+0.4	-
1/2 PMF	910	880	993.6	-0.7	1.5
PMF	1830	1790	994.4	-1.5	5.3
0.28 PMF	500	400	992.9	0	-

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a high hazard rating and a small size. The Standard Design Flood for a small dam varies from one-half PMF to PMF. In consideration of the small volume of water impounded, the large flood plain downstream and the maximum of four houses downstream, one-half PMF is the appropriate spillway design flood.

The St. Louis District, Corps of Engineers, in a letter dated 11 August, 1978 has estimated the damage zone as extending 1.5 miles downstream from the dam. Within the damage zone are three to four houses, two unimproved roads, and two improved roads. Also located just downstream from the dam is a much smaller dam.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations of features which could adversely affect the stability of the dam are discussed in Section 3. These include the following features: brush and trees on the upstream and downstream slopes, the fence along the crest of the weir, the erosion of the principal spillway outlet channel at the downstream toe, and the seepage below the outlet channel at the downstream toe.

b. Design and Construction Data. No design or construction data were available.

c. Operating Records. There are no operating structures at this dam.

d. Post-Construction Changes. The auxiliary spillway was constructed when the road across the dam was paved in 1960 or 1961. The four 48-inch CMP in the primary spillway are obviously not 75 to 100 years old, as is the dam. It is not known when this modification was made.

e. Seismic Stability. This dam is in Seismic Zone 1. An earthquake of the magnitude used for design in this zone is not expected to cause structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. Several items were noted during the visual inspection which could seriously threaten the safety of the dam if not controlled. These items include trees and brush on sections of the upstream and downstream slopes of the dam, erosion of the primary spillway outlet channel at the downstream toe of the dam, seepage below the primary spillway outlet channel, and the wire fence along the crest of the spillway weir. The Probable Maximum Flood will overtop the dam, as will the 1/2 PMF. The spillway will pass 28% of the PMF before the dam is overtopped. The dam will retain the 100-year flood without overtopping.

b. Adequacy of Information. Since no engineering or construction data were available, the conclusions of this report are based upon performance history and visual observations. The inspection team considers that these data are sufficient to support the conclusions herein. Neither a seepage nor a stability analysis were found. This is a deficiency which should be corrected in the near future.

c. Urgency. The remedial measures recommended in Paragraph 7.2, below, should be accomplished in the near future.

d. Necessity for Phase II. A Phase II investigation is not called for. However, additional engineering data and analyses should be obtained by the owner to evaluate and design recommended remedial measures.

e. Seismic Stability. The dam is located in Seismic Zone 1. An earthquake of the magnitude used for design in this seismic zone is not expected to be hazardous to this dam.

7.2 REMEDIAL MEASURES

a. Alternatives. The size of the spillway and/or the height of the dam should be increased and/or the permanent pool elevation should be lowered so that the Probable Maximum Flood can be passed without overtopping the dam. Regardless of which of these alternatives is chosen, additional investigations and analyses should be conducted to determine the structural characteristics and stability of the present embankment. These analyses should include a seepage analysis to determine the source of the seepage below the primary spillway exit channel near the downstream toe. The services of an engineer

experienced in the design of dams should be obtained to perform the investigations and analyses of the present dam and to design the appropriate modifications and remedial measures.

b. O & M Maintenance and Procedures. The following O & M maintenance and procedures are recommended.

(1) A program should be developed and put into action to remove trees and brush from the embankment and from the primary and auxiliary spillway exit channel and to permanently control vegetation in these areas to promote the growth of grass and prevent the regrowth of trees and brush.

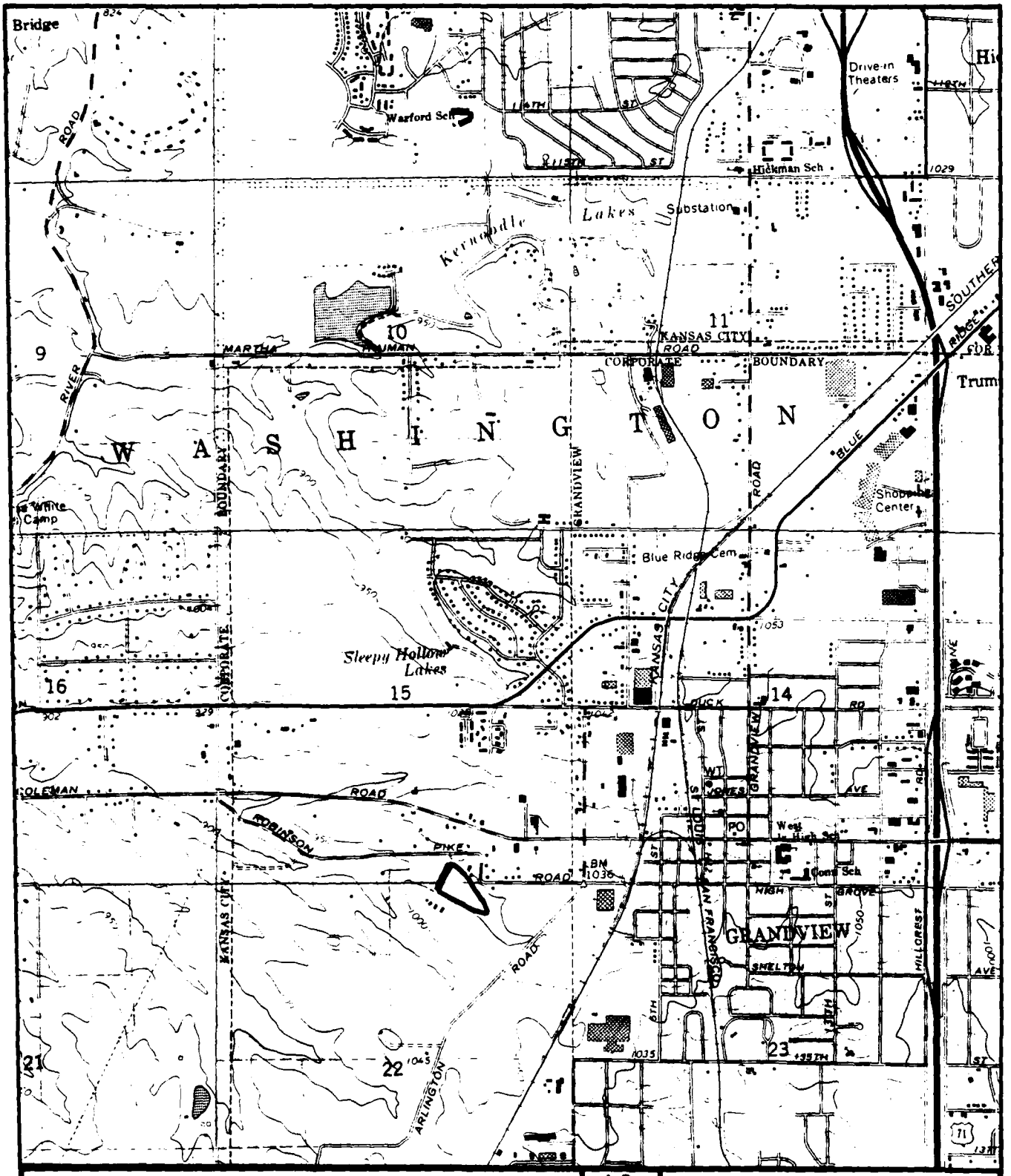
(2) The erosion in the primary spillway exit channel should be repaired and the spillway should be protected to prevent erosion.

(3) The wire fence along the crest of the weir should be removed.

(4) Deteriorated concrete in the weir should be removed and replaced.

(5) The dam should be inspected regularly by qualified personnel to determine the presence of seepage on the downstream slope, in the abutments, below the downstream toe, or out of the exit channel, to determine the presence of slides in the downstream slope, to observe the upstream slope for any erosional damage, and to check for further deterioration of the concrete in the weir.

APPENDIX A
MAPS



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1000 500 0 1000
SCALE IN METERS

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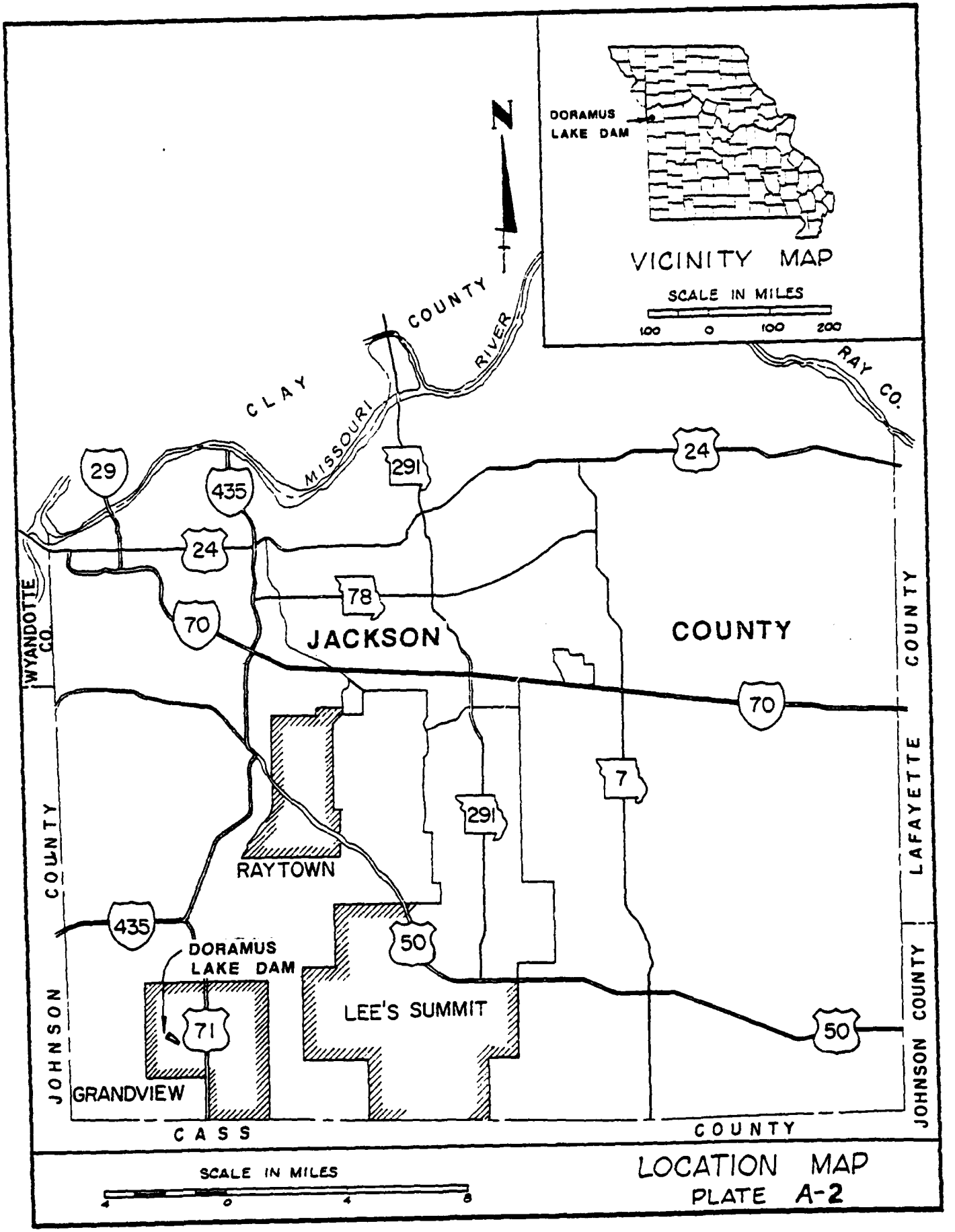
DORAMUS LAKE DAM

VICINITY TOPOGRAPHY

PLATE A-1


DORAMUS
LAKE DAM
VICINITY MAP
SCALE IN MILES
100 0 100 200
N
CLAY COUNTY
MISSOURI RIVER
RAY CO.
29
435
291
24
78
70
JACKSON
COUNTY
WYANDOTTE CO.
7
RAYTOWN
LAFAYETTE COUNTY
JOHNSON COUNTY
50
DORAMUS
LAKE DAM
LEE'S SUMMIT
71
GRANDVIEW
JOHNSON
CASS
COUNTY
SCALE IN MILES
4 0 4 8
LOCATION MAP
PLATE A-2

APPENDIX B
PHOTOGRAPHS

PHOTO NO. 2
UPSTREAM FACE
FROM LEFT ABUTMENT

PHOTO NO. 3
GRAVEL ON UPSTREAM
FACE CENTER LINE
STATION 3+25 TO 3+60

PHOTO NO. 4
PRIMARY SPILLWAY WEIR

PLATE B-1

PHOTO NO. 5
CMP OUTLET PIPES
FOR PRIMARY SPILLWAY

PHOTO NO. 6
EROSION IN PRIMARY
SPILLWAY EXIT CHANNEL

PHOTO NO. 7
AREA OF SEEPAGE
RIGHT OF PRIMARY
SPILLWAY EXIT CHANNEL

PHOTO NO. 8
SECONDARY SPILLWAY
INLET AT RIGHT
ABUTMENT

PHOTO NO. 9
SECONDARY SPILLWAY
CMP INLETS

PHOTO NO. 10
SECONDARY SPILLWAY
EXIT CHANNEL

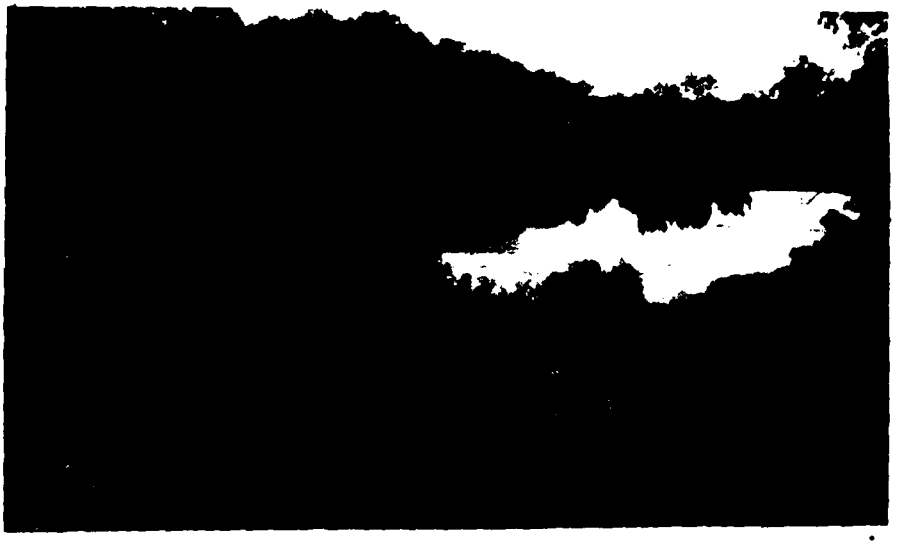
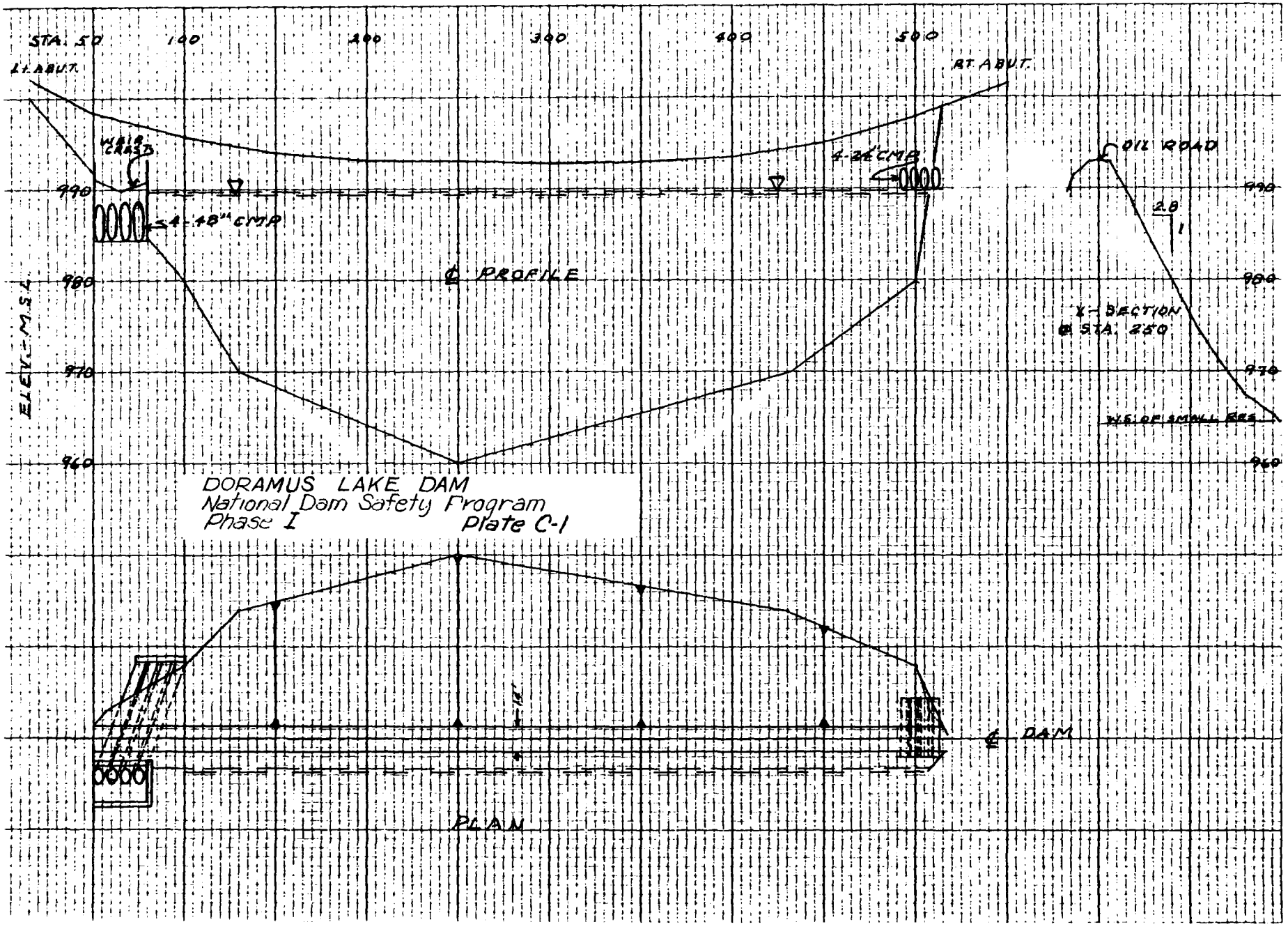


PHOTO NO. 11
DOWNSTREAM FACE
FROM BELOW RIGHT
ABUTMENT

PHOTO NO. 12
LOOKING DOWNSTREAM
FROM CREST OF DAM
TO SMALLER DAM BELOW

APPENDIX C
PLAN, PROFILES & SECTION


STA. 50
100
200
300
400
500
LT. ABUT.
RT. ABUT.
WEIR CREST
990
980
970
960
ELEV. M.S.L.
1-48" CMP
2-24" CMP
℄ PROFILE
OIL ROAD
2:1
X-SECTION @ STA. 250
TYP. OF SMALL DAMS
DORAMUS LAKE DAM
National Dam Safety Program
Phase I
Plate C-1
℄ DAM
PLAN

APPENDIX D
HYDROLOGIC COMPUTATIONS

HYDROLOGIC COMPUTATIONS

1. The Mockes dimensionless standard curvilinear unit hydrograph and the SCS TR-20 program were used to develop the inflow hydrographs (see Plate D1). The inflow hydrograph for the 100-year flood was generated by the consultant using the TR-20 program.

   a. Six-hour, twelve-hour, and twenty-four hour 100-year rainfall for the dam location was taken from NOAA Technical Paper 40. The 24-hour probable maximum precipitation was taken from the curves of Hydrometeorological Report No. 33 and current Corps of Engineers and St. Louis District policy and guidance for hydraulics and hydrology.

   b. Drainage area = 0.287 square mile (184 acres).

   c. Time of concentration of runoff = 21 minutes.

   d. The antecedent storm conditions were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMCIII). The initial pool elevation was assumed at the crest of the primary spillway.

   e. The total 24-hour storm duration losses for the 100-year storm were 0.87 inch. The total losses for the 24-hour duration 1/2 PMF storm were 0.91 inch. The total losses for the PMF storm were 0.95 inch. These data are based on SCS runoff curve No. 93 and antecedent moisture conditions from SCS AMCIII.

   f. Average soil loss rates = 0.05 inch per hour approximately.

2. The weir/culvert discharge ratings were developed using standard formulas. The flows over the dam crest were based on the broad-crested weir equation $Q = CLH^{3/2}$, where H is the head on the dam crest; the coefficient C, which varies with head, was taken from the USGS publication "TWRI, Book 3, Chapter 5, Measurement of Peak Discharge at Dams by Indirect Methods".

3. Floods were routed through the reservoir using the TR-20 program to determine the capabilities of the spillways and dam embankment crest. The storm rainfall patterns, inflow hydrographs and routed outflow hydrographs are shown on Plate D2.

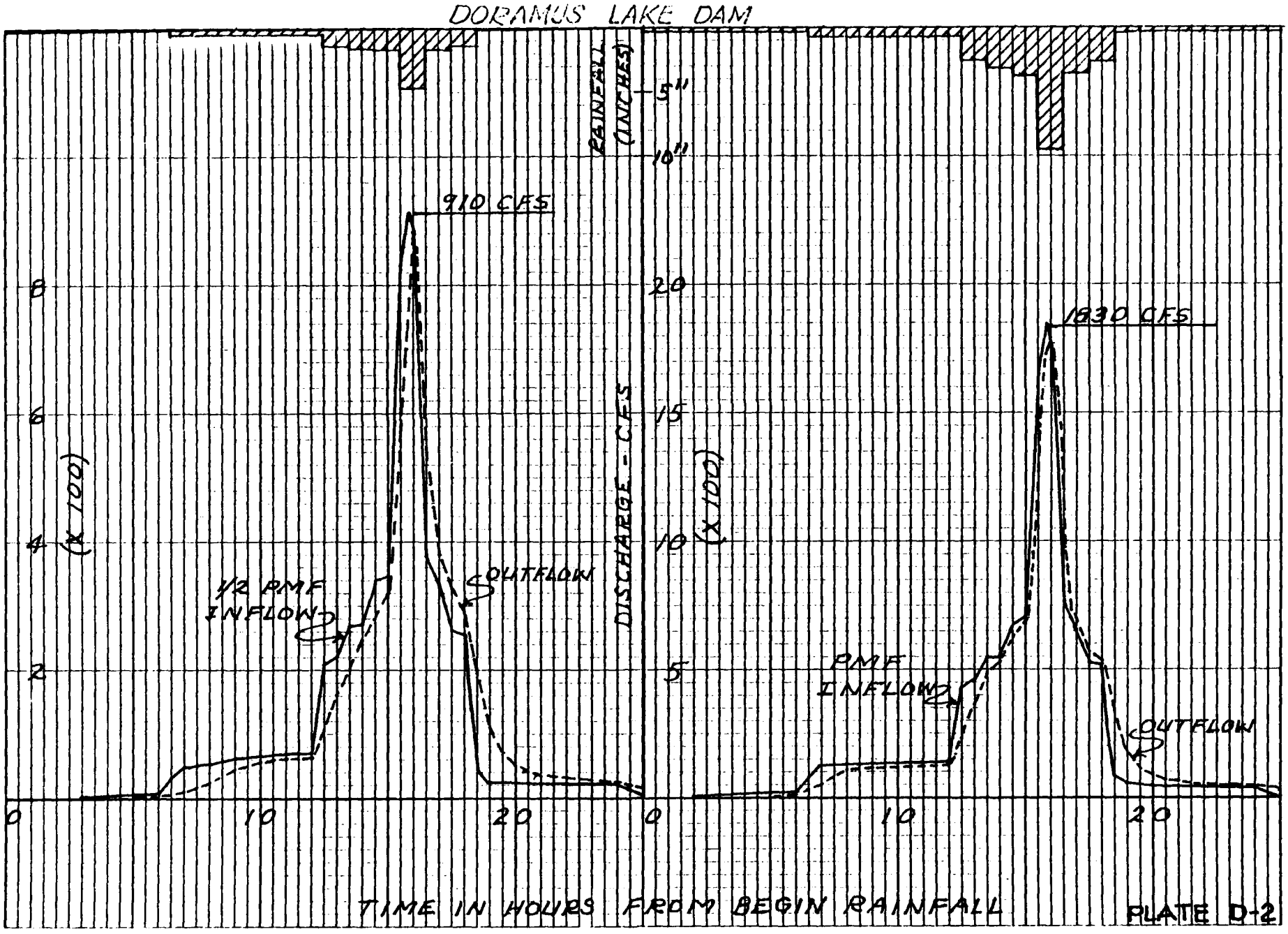


PLATE D-2

HOSKINS-WESTERN-SONDEREGGER

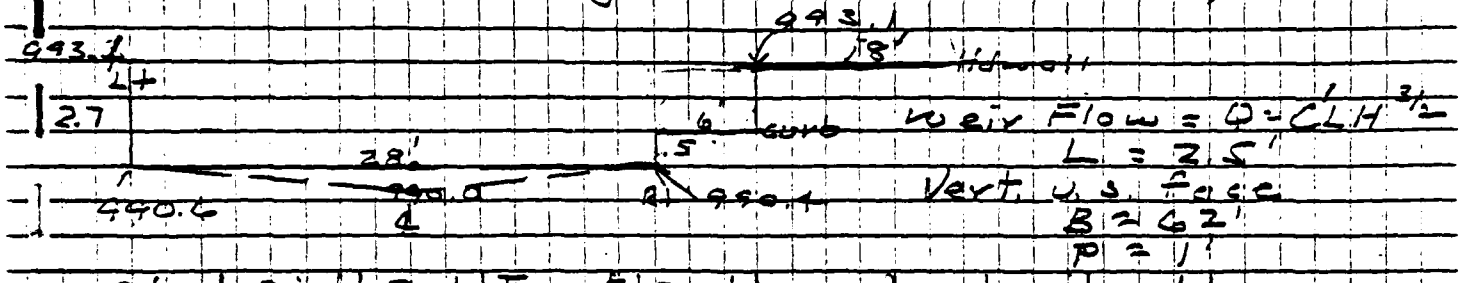
COMPUTED BY GGJ DATE 10/16/78 SHEET NO. ___ OF ___

CHECKED BY ___ DATE ___ JOB NUMBER 78-309-5

CALCULATIONS FOR

PROJECT Flr Dam Insp.
DORAMUS DAM
(No Name 8J-20139

Weir Flow Rating



Weir Flow = $Q = C'LH^{3/2}$

L = 2.5'

Vert. u.s. face

B = 62'

P = 1'

Sta	Dist b	Pool elev	Top of weir	Dept d	Min depth	H/L	C	C'	Q
Lt end		990.6	990.6	0					
	14				.3	.12	2.63	2.50	6
℄			990.0	.6					
	14	990.6			.4	.16	2.63	2.50	9
Rt End			990.4	.2					
									15
Lt end		990.9	990.6	.3					
	14				.6	.24	2.63	2.42	16
℄			990.0	.9					
	14				.7	.28	2.63	2.42	20
Rt E		990.9	990.4	.5					
									36
						6/8 = .75			
Lt. E		991.4	990.6	.8					
	14				1.1	.44	2.66	2.37	39
℄			990.0	1.4					
	14				1.2	.48	2.67	2.35	43
Rt. E			990.4	1.0					
Lt Curb			990.9	.5					
	6				.5	.2	2.63	2.50	5
Rt Curb		991.4	990.9	.5					
									86
Lt. E		991.9	990.6	1.3					
	14				1.6	.64	2.75	2.36	67
℄			990.0	1.9					
	14				1.7	.68	2.77	2.35	73
Rt. E			990.4	1.5					
Lt. Curb			990.9	1.0					
	6				1.0	.4	2.67	2.38	14
Rt Curb		991.4	990.9	1.0					
									154

PLATE D-3

HOSKINS-WESTERN-SONDEREGGER

CALCULATIONS FOR

COMPUTED BY GSJ DATE 12/16/78 SHEET NO. ____ OF ____

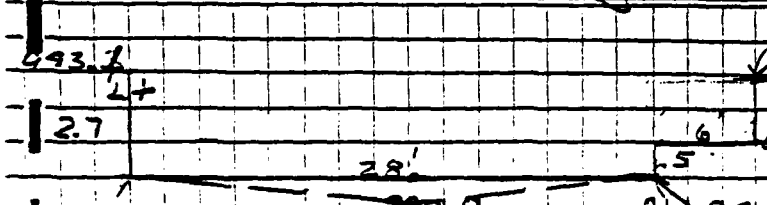
CHECKED BY ____ DATE ____ JOB NUMBER 78209.5

PROJECT Co Dam. Insp.

DORAMUS DAM

(No Name 8SJ20139

Weir Flow Rating



Weir Flow = $Q = C'LH^{3/2}$

L = 25'

Vert. u.s. face

B = 62'

P = 11'

Sta	Dist b	Bot elev	Top of weir	Dept d	Max depth	hr/L	C	C'	Q
						or 63.55			
Lt E		993.1	990.6	2.5					
	14				2.8	1.12	3.05	2.44	160
℄			990.0	3.1					
	14				2.9	1.16	3.08	2.46	170
Rt E			990.4	2.7					
Lt. Curb			990.9	2.2					
	6				2.2	.88	2.90	2.38	47
Rt. Curb		993.1	990.9	2.2					
									377
					b/B = .84				
		993.5							
Lt E			990.6	2.9					
	14				3.2	1.28	3.16	2.84	207
℄			990.0	3.5					
	14				3.3	1.32	3.13	2.86	240
Rt. E			990.4	3.1					
Lt Curb			990.9	2.6					
	6				2.6	1.04	3.00	2.73	69
Rt Curb			990.9	2.6					
Lt HW			993.1	.4					
	18				.4	.16	2.63	2.55	12
Rt HW		993.5	993.1	.4					
									528
Lt E		994.0	990.6	3.4					
	14				3.7	1.48	3.28	2.95	294
℄			990.0	4.0					
	14				3.8	1.52	3.30	2.97	308
Rt. E			990.4	3.6					
Lt. Curb			990.9	3.1					
	6				3.1	1.24	3.14	2.83	93
Rt. Curb			990.9	3.1					
Lt. HW			993.1	.9					
	18				.9	.36	2.65	2.41	37
Rt. HW		994.0	993.1	.9					
									732

PLATE D-4

HOSKINS-WESTERN-SONDEREGGER

COMPUTED BY GGJ DATE 10/16/78 SHEET NO. ___ OF ___

CHECKED BY ___ DATE ___ JOB NUMBER 78/309.5

CALCULATIONS FOR

PROJECT OORAMUS DAM (No Name #5) #20139

Culvert Flow Rating

Use nomograph Fig. 4-18, pg. 164, Hyd of Culverts "Handbook of Steel Drainage & Highway Const. Products"

Culverts at Left end of Dam below Weir

Mitered
4-48" CMPs Assume Inlet control

PZF = 984.5

Elev	HW	HW/D(4')	Q	x4 = Total Q
Sill elev 990.0	5.5	1.38	95	380
990.6	6.1	1.52	104	416
990.9	6.4	1.6	110	440
991.4	6.9	1.72	112	448
991.9	7.4	1.85	120	480
993.1	8.6	2.15	135	540
993.5	9.0	2.25	140	560
994.0	9.5	2.38	145	580
994.5	10.0	2.5	150	600

4 - 24" Culverts @ Rt. end dam
Headwall Flush
PZF = 990.0

		D=(2)		
990.0	—	—	—	0
990.6	.6	.3	10	40
990.9	.9	.45	3.5	14
991.4	1.4	.7	7.5	30
991.9	1.9	.95	12	48
993.1	3.1	1.55	20	80
993.5	3.5	1.75	24	96
994.0	4.0	2.0	26	104
994.5	4.5	2.55	30	120

PLATE D-5

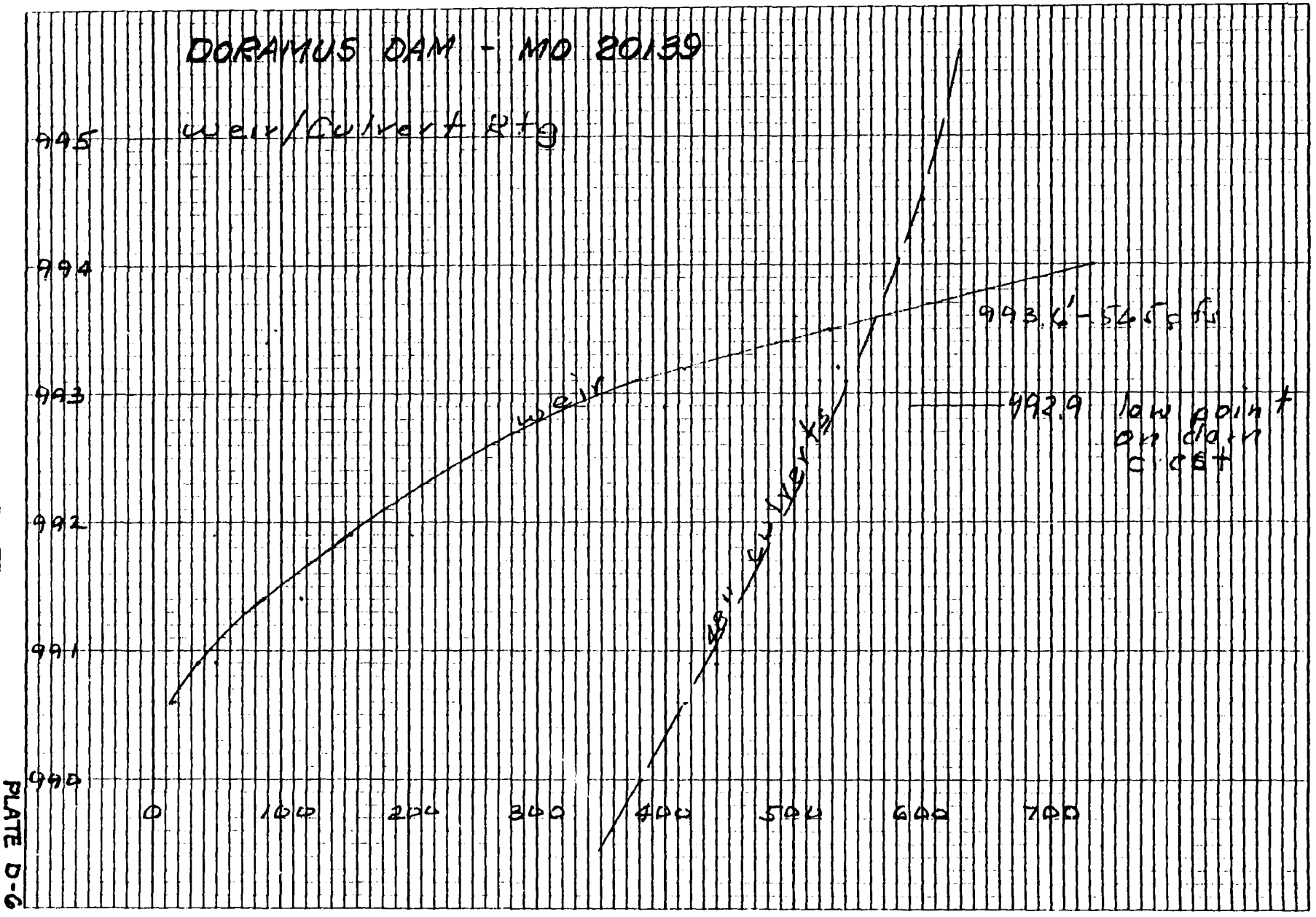


PLATE D-6

HOSKINS-WESTERN-SONDEREGGER

CALCULATIONS FOR

COMPUTED BY GGJ DATE 10/13/78 SHEET NO. 1 OF ____

CHECKED BY ____ DATE ____ JOB NUMBER 78/3005

PROJECT No Name Inst.

DORAMUS DAM

Flow over Dam Embankment (No Name 85) = 20139

See TWRI, B-3, Ch 3, p. F-5 $Q = CLH^{3/2}$

Sta	Dist. b	Pool Elev.	Top of Dam Elev.	Depth h	Min h	Max 1:14	C	Q
			Paved					
1+00			995.9					
1+50			994.0					
2+00		993.2	993.2	0				
	50				.05	.15	290	2
2+50		993.2	993.1	.1				
	50				.20		297	13
3+00		993.2	992.9	.3				
	50				.25		298	19
3+50		993.2	993.0	.2				
	20				.10		293	2
~~3+70~~ 4+00		993.2	993.5	0				
4+50			995.0					
5+00			997.8					
								36

PLATE D-7

JOSKINS-WESTERN-SONDEREGGER

CALCULATIONS FOR

COMPUTED BY GGJ DATE 10/13/78 SHEET NO. 2 OF ____

CHECKED BY ____ DATE ____ JOB NUMBER 78/3095

PROJECT Mo Dam Insp.

DORAMUS DAM

(Flow over Dam Embankment (No Name 85) = 20,139 cfs

See TWRI, Bk 3, Chap. A-5 $Q = CbH^{3/2}$

Sta.	Dist b	Pool Elev.	Top of Dam Elev.	Depth h	Mn h	Mn 1:1	C	Q
1+00			995.9					
1+~~50~~		993.5	994.0	0				
	23				.15	4.15	2.95	4
2+00			993.2	.3				
	50				.35		3.00	31
2+50			993.1	.4				
	50				.50		3.02	53
3+00			992.9	.6				
	50				.55		3.02	62
3+50			993.0	.5				
	50				.25		2.98	19
4+00		993.5	993.5	0				
4+50			995.0					
5+00			997.8					
								169

PLATE D-8

HOSKINS-WESTERN-SONDEREGGER

CALCULATIONS FOR

COMPUTED BY SSJ DATE 12/13/79 SHEET NO. 3 OF

CHECKED BY DATE JOB NUMBER 78/3095

PROJECT Mo Dam Insp.

DORAMUS DAM

Flow over Dam Embankment (No Name 85) = 20139

Sec T W R I, R C 3, Ch 0. 4-5 $Q = CbH^{3/2}$

Sta	Dist b	Pool Elev.	Top of Dam Elev.	Depth h	Mn h	Mh Z=14	C	Q
1+00			995.9					
1+50		994.0	994.0	0				
	50				.4	<1.5	300	33
2+00			993.2	.8				
	50				.85		3.03	119
2+50			993.1	.9				
	50				1.0		304	152
3+00			992.9	1.1				
	50				1.05		3.04	164
3+50			993.0	1.0				
	50				.75		3.03	114
4+00			993.5	.5				
	16				.25		298	6
4+~~58~~ 66		994.0	993.0	0				
5+00			997.8					
								593

PLATE D-9

HOSKINS-WESTERN-SONDEREGGER

CALCULATIONS FOR

COMPUTED BY GGJ DATE 10/13/78 SHEET NO. ____ OF ____

CHECKED BY ____ DATE ____ JOB NUMBER 78/3095

PROJECT Mo Dam Insp.

DORAMUS DAM

Flow over Dam Embankment (No Name St) = 2013.9

See TWRI, Bk 3, Chap. A-5 $Q = CbH^{3/2}$

Sta.	Dist. b	Pool Elev.	Top of Dam Elev.	Depth h	Mn b	My L=14	C	Q
1+~~00~~ 35		994.5	99~~5.0~~ 5	0				
	15				.25	≤1.5	293	6
1+50			994.0	.5				
	50				.9		303	29
2+00			993.2	1.3				
	50				1.35		304	238
2+50			993.1	1.4				
	50				1.5		304	279
3+00			992.9	1.6				
	50				1.55		304	293
3+50			993.0	1.5				
	50				1.35		304	212
4+00			993.5	1.0				
	35				.5		302	37
4+~~50~~ 35		994.5	99~~5.0~~ 5	0				
5+00			997.8					
								1194

PLATE D-10

HOSKINS-WESTERN-SONDEREGGER

CALCULATIONS FOR

COMPUTED BY GGJ DATE 10/16/78 SHEET NO. ___ OF ___

CHECKED BY ___ DATE ___ JOB NUMBER 78/309

PROJECT Mo Dam Insp.

DORAMUS DAM (No Name 85) - # 20139

Total Flow

Elev.	Weir	48" Culv.	24" Culv	Embank.	Total
990.0	0	—	0	—	0
990.6	15		4		19
990.9	36		14		50
991.4	86		30		116
991.9	154		48		202
dam 992.9	325		75	0	400
993.2	415		84	36	535
993.5	528	~~550~~	96	169	793
994.0	~~732~~	580	104	593	1277
994.5		600	120	1194	1914

Weir to dam

PLATE D-11

HYDROLOGY PROGRAM FOR IBM 1130 - DATED JULY, 1968

MO DAM INSP-NO NAME 85) DORAMUS DAM

EXECUTIVE CONTROL CARD OPERATION LIST

TR-20 ROUTING.

```
MO DAM INSP-NO NAME 85
C TABLE          VELOCITY INCREMENT =  0.200
 8                0.0000    0.0800    0.1800    0.2500    0.3200
 8                0.3700    0.4100    0.4500    0.4900    0.5100
 8                0.5400    0.5700    0.5900    0.6100    0.6300
 8                0.6500    0.6600    0.6700    0.6900    0.7000
 8                0.7100    0.7200    0.7300    0.7400    0.7500
 8                0.7600    0.7700    0.7700    0.7800    0.7900
 8                0.7900    0.8000    0.8100    0.8100    0.8200
 8                0.8200    0.8300    0.8300    0.8400    0.8400
 8                0.8400    0.8500    0.8500    0.8600    0.8600
 8                0.8600    0.8600    0.8700    0.8700    0.8700
 8                0.8800    0.8800    0.8800    0.8900    0.8900
 8                0.8900    0.8900    0.8900    0.8900    0.9000
 8                0.9000    0.9000    0.9000    0.9000    0.9100
 8                0.9100    0.9100    0.9100    0.9100    0.9100
 8                0.9200    0.9200    0.9200    0.9200    0.9200
 8                0.9200    0.9200    0.9200    0.9300    0.9300
 9 ENDTBL
STRUCTURE NO.  1
                        ELEVATION   DISCHARGE     STORAGE
 8                       990.0001      0.0000     70.0000
 9 ENDTBL
DIMENSIONLESS HYDROGRAPH - DELTA T =484.00
 8                0.0000    0.0300    0.1000    0.1900    0.3100
 8                0.4700    0.6600    0.8200    0.9300    0.9900
 8                1.0000    0.9900    0.9300    0.8600    0.7800
 8                0.6800    0.5600    0.4600    0.3900    0.3300
 8                0.2800    0.2410    0.2070    0.1740    0.1470
 8                0.1260    0.1070    0.0910    0.0770    0.0660
 8                0.0550    0.0470    0.0400    0.0340    0.0290
 8                0.0250    0.0210    0.0180    0.0150    0.0130
 8                0.0110    0.0090    0.0080    0.0070    0.0060
 8                0.0050    0.0040    0.0030    0.0020    0.0010
 8                0.0000    0.0000    0.0000    0.0000    0.0000
 9 ENDTBL
RAINFALL TABLE NO. 1      TIME INCREMENT =  0.50
 8                0.0000    0.0080    0.0170    0.0260    0.0350
 8                0.0450    0.0550    0.0650    0.0760    0.0870
 8                0.0990    0.1120    0.1250    0.1400    0.1560
 8                0.1740    0.1940    0.2190    0.2540    0.3030
 8                0.5150    0.5830    0.6240    0.6540    0.6820
 8                0.7050    0.7270    0.7480    0.7670    0.7840
 8                0.8000    0.8160    0.8300    0.8440    0.8570
 8                0.8700    0.8820    0.8930    0.9050    0.9160
 8                0.9260    0.9360    0.9460    0.9550    0.9650
 8                0.9740    0.9830    0.9920    1.0000    1.0000
 9 ENDTBL
RAINFALL TABLE NO. 2      TIME INCREMENT =  0.02
 8                0.0000    0.0100    0.0200    0.0200    0.0300
 8                0.0400    0.0500    0.0600    0.0700    0.0800
 8                0.1000    0.1100    0.1300    0.1400    0.1700
 8                0.1900    0.2200    0.2700    0.3500    0.4400
 8                0.5200    0.6000    0.6300    0.6600    0.6800
 8                0.7000    0.7200    0.7400    0.7600    0.7700
 8                0.7900    0.8000    0.8200    0.8300    0.8400
 8                0.8500    0.8700    0.8800    0.8900    0.9000
 8                0.9100    0.9200    0.9300    0.9400    0.9500
 8                0.9567    0.9633    0.9700    0.9800    0.9900
 8                1.0000    1.0000    1.0000    1.0000    1.0000
 9 ENDTBL
RAINFALL TABLE NO. 3      TIME INCREMENT =  0.50
 8                0.0000    0.0700    0.1400    0.2100    0.2900
```

PLATE D-12

```
8          0.3600    0.4400    0.5100    0.5900    0.6600
8          0.7400    0.8100    0.8900    1.2000    1.6700
8          2.0600    2.4500    2.8400    3.2300    3.6200
8          4.0200    4.4100    4.8100    5.2000    5.6000
8          6.8600    8.1300    9.6500   11.1700   13.0700
8         14.9700   19.7700   24.5800   26.3500   28.1200
8         29.5100   30.9000   31.0100   31.1300   31.2400
8         31.3600   31.4700   31.5800   31.6700   31.8000
8         31.9100   32.0200   32.1300   32.2400   32.2400
9 ENDTBL
RAINFALL TABLE NO. 4      TIME INCREMENT =  0.50
8          0.0000    0.0300    0.0600    0.0900    0.1200
8          0.1500    0.1800    0.2100    0.2400    0.2700
8          0.3000    0.3300    0.3600    0.4500    0.5400
8          0.6300    0.7200    0.8100    0.9000    0.9900
8          1.0800    1.1700    1.2700    1.3600    1.4600
8          1.7400    2.0300    2.3700    2.7100    3.1300
8          3.5600    4.6400    5.7300    6.1300    6.5300
8          6.8400    7.1600    7.2000    7.2500    7.2900
8          7.3400    7.3800    7.4300    7.4700    7.5200
8          7.5600    7.6100    7.6500    7.7000    7.7000
9 ENDTBL
```

PLATE D-13

STANDARD CONTROL INSTRUCTIONS

			HYDROGRAPHS						OUTPUT OPTIONS					
SUBRTN	XSLCTN	STRCT	IN1	IN2	OUT	DATA NO. 1	DATA NO. 2	DATA NO. 3	PK	H	E	V	PH	SP
RUNOFF	0	1	0	0	6	0.287	85.000	0.350	1	1	0	1	0	0
RESVOR	0	1	6	0	7	900.000	0.000	0.000	1	1	1	1	0	0
ENDATA														

END OF LISTING

PLATE D-14

ADDITIONS TO TABULAR DATA FOLLOW

STRUCTURE NO. 1

8	990.0001	0.0000	70.0000 ← Top spillway & Inv. 24" Culverts
8	990.6000	19.0000	75.0000
8	990.9000	50.0000	78.0000
8	991.4000	116.0000	82.5000
8	991.9000	202.0000	87.5000
8	992.9000	400.0000	97.0000 ← Top of Dam
8	993.2000	535.0001	100.0000
8	993.5001	793.0001	103.5000
8	994.0001	1277.0002	108.0000
8	994.5001	1914.0002	114.0000

EXECUTIVE CONTROL CARD OPERATION INCREM. MAIN TIME INCREMENT= 0.25
EXECUTIVE CONTROL CARD OPERATION COMPUT. FROM XSECTN/STRUCT 0/ 1 TO XSECTN/STRUCT 0/ 1
STARTING TIME= 0.00 RAIN DEPTH= 1.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 3 SOIL CONDITION= 3
ALTERNATE NO.= 1 STORM NO.= 1

SUBROUTINE RUNOFF STRUCTURE 1
AREA= 0.28 INPUT RUNOFF CURVE= 85.0 TIME OF CONCENTRATION= 0.35
COMPUTED CURVE NO. = 92.8

PMF

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
4.11	16.469	(RUNOFF)
5.06	19.156	(RUNOFF)
10.03	143.158	(RUNOFF)
11.01	144.445	(RUNOFF)
15.87	1834.328	(RUNOFF)
19.99	44.030	(RUNOFF)
22.60	40.681	(RUNOFF)
23.87	43.196	(RUNOFF)

HYDROGRAPH, TZERO= 1.25 DELTA T= 0.25 DRAINAGE AREA= 0.28

TIME											
1.25	DISCHG	0.00	1.22	3.40	5.75 1	7.25	8.36	10.28	12.193	12.67	12.95
3.75	DISCHG	14.63	16.294	16.19	15.97	17.55	19.085	18.61	18.09	19.58	21.076
6.25	DISCHG	65.06	105.78	118.03	123.717	127.28	129.91	131.97	133.618	134.95	136.06
8.75	DISCHG	136.98	137.759	138.41	139.00	141.23	143.130	142.04	140.93	142.74	144.4211
11.25	DISCHG	143.17	141.95	143.63	145.2712	301.08	431.14	458.01	465.3313	511.58	550.20
13.75	DISCHG	557.89	560.5014	629.11	687.37	698.75	701.1215	1231.98	1673.71	1758.73	1769.3016
16.25	DISCHG	1224.42	759.32	672.93	656.0017	585.58	527.53	516.49	514.4518	279.76	84.83
18.75	DISCHG	50.15	44.9019	42.51	41.03	42.58	44.0320	42.51	41.04	40.75	40.7021
21.25	DISCHG	40.69	40.69	40.69	40.6922	40.69	40.69	40.69	40.6923	40.69	40.69
23.75	DISCHG	40.69	40.6824	20.55	3.79	0.65	0.0725	0.00			

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 31.2982 (32.24 / .95) CFS-HRS= 5797.09 ACRE-FT= 479.07

SUBROUTINE RESVOR STRUCTURE 1
SURFACE ELEVATION= 990.00

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
15.90	1789.556	994.40

HYDROGRAPH, TZERO= 1.25 DELTA T= 0.25 DRAINAGE AREA= 0.28

TIME											
1.25	DISCHG	0.00	0.04	0.21	0.542	0.99	1.51	2.10	2.793	3.52	4.22
1.25	ELEV	990.00	990.00	990.00	990.01	990.03	990.04	990.06	990.08	990.11	990.13
3.75	DISCHG	4.94	5.744	6.53	7.25	7.97	8.75 5	9.51	10.18	10.83	11.556
3.75	ELEV	990.15	990.18	990.20	990.22	990.25	990.27	990.30	990.32	990.34	990.36
6.25	DISCHG	13.93	19.86	37.62	55.027	73.56	88.05	99.33	108.148	115.02	121.06
6.25	ELEV	990.44	990.60	990.78	990.937	991.07	991.18	991.27	991.34	991.39	991.42
8.75	DISCHG	125.72	129.249	131.91	133.96	135.82	137.7410	139.20	139.89	140.48	141.4111
8.75	ELEV	991.45	991.47	991.49	991.50	991.51	991.52	991.53	991.53	991.54	991.54
11.25	DISCHG	142.13	142.26	142.42	143.0312	167.22	231.63	307.08	361.8613	412.04	467.50
11.25	ELEV	991.55	991.55	991.55	991.55	991.69	992.04	992.43	992.70	992.92	993.09
13.75	DISCHG	529.76	553.3114	589.19	648.89	687.08	696.1915	960.05	1477.53	1727.23	1765.7116
13.75	ELEV	993.18	993.22	993.26	993.33	993.37	993.38	993.67	994.15	994.35	994.38
16.25	DISCHG	1484.45	967.23	719.00	671.8517	627.70	566.19	529.85	520.7218	442.25	431.47
16.25	ELEV	994.16	993.68	993.41	993.35	993.30	993.23	993.18	993.16	992.99	992.56
18.75	DISCHG	257.94	175.1519	135.48	108.33	90.82	78.3220	69.09	61.90	56.37	52.2621
18.75	ELEV	992.08	991.74	991.51	991.34	991.20	991.11	991.04	990.99	990.94	990.91

PLATE D-15

21.25	DISCHG	49.42	47.74	46.38	45.28	44.40	43.68	43.10	42.64	42.26	41.96
21.25	ELEV	990.89	990.87	990.86	990.85	990.84	990.83	990.83	990.82	990.82	990.82
23.75	DISCHG	41.71	41.52	39.41	34.16	28.00	22.67	18.72	17.31	16.00	14.79
23.75	ELEV	990.81	990.81	990.79	990.74	990.68	990.63	990.59	990.54	990.50	990.46

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 31.0582 CFS-HRS= 5752.65 ACRE-FT= 475.39

ENDCMP 1

PLATE D-16

EXECUTIVE CONTROL CARD OPERATION COMPUT. FROM XSECTN/STRUCT 0/ 1 TO XSECTN/STRUCT 0/ 1
STARTING TIME= 0.00 RAIN DEPTH= 0.50 RAIN DURATION= 1.00 RAIN TABLE NO.= 3 SOIL CONDITION= 3
ALTERNATE NO.= 1 STORM NO.= 4

SUBROUTINE RUNOFF STRUCTURE 1
AREA= 0.28 INPUT RUNOFF CURVE= 85.0 TIME OF CONCENTRATION= 0.55
COMPUTED CURVE NO. = 92.8

1/2 PMF

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
10.09	66.922	(RUNOFF)
11.05	68.657	(RUNOFF)
15.88	913.435	(RUNOFF)
19.99	21.985	(RUNOFF)
23.87	21.589	(RUNOFF)

HYDROGRAPH, TZERO= 2.75 DELTA T= 0.25 DRAINAGE AREA= 0.28

TIME											
2.75	DISCHG	0.00	1.403	1.95	2.32	2.95	3.594	3.83	3.99	4.61	5.235
5.25	DISCHG	5.29	5.31	5.92	6.546	21.37	36.97	43.71	47.997	51.21	53.79
7.75	DISCHG	55.93	57.718	59.21	60.49	61.59	62.549	63.37	64.11	65.56	66.8310
10.25	DISCHG	66.66	66.44	67.56	68.61	68.24	67.86	68.85	69.8012	145.26	208.90
12.75	DISCHG	222.88	227.283	250.69	270.39	274.76	276.5714	310.96	340.25	346.32	347.8615
15.25	DISCHG	612.05	832.50	875.70	881.6716	610.43	378.67	335.66	327.2717	292.17	263.24
17.75	DISCHG	257.75	256.758	139.63	42.34	25.03	22.419	21.21	20.48	21.25	21.9720
20.25	DISCHG	21.22	20.48	20.34	20.3121	20.31	20.31	20.31	20.3122	20.31	20.31
22.75	DISCHG	20.31	20.313	20.31	20.31	20.31	20.3124	10.25	1.89	0.32	0.0525
25.25	DISCHG	0.00									

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 15.2103 CFS-HRS= 2817.27 ACRE-FT= 232.81
16.12
0.91

SUBROUTINE RESVOR STRUCTURE 1
SURFACE ELEVATION= 990.00

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
15.95	885.491	993.59

← 48% calculate downstream control

HYDROGRAPH, TZERO= 2.75 DELTA T= 0.25 DRAINAGE AREA= 0.28

TIME											
2.75	DISCHG	0.00	0.053	0.18	0.32	0.50	0.714	0.93	1.16	1.40	1.665
2.75	ELEV	990.00	990.003	990.00	990.01	990.01	990.024	990.02	990.03	990.04	990.055
5.25	DISCHG	1.94	2.19	2.45	2.736	3.58	5.52	8.15	10.997	13.91	16.83
5.25	ELEV	990.06	990.06	990.07	990.08	990.11	990.17	990.25	990.347	990.43	990.53
7.75	DISCHG	20.79	27.748	33.67	38.72	43.02	46.709	49.84	53.44	56.44	59.0010
7.75	ELEV	990.61	990.68	990.74	990.79	990.83	990.869	990.89	990.92	990.94	990.9610
10.25	DISCHG	61.04	62.49	63.68	64.8411	65.78	66.38	66.90	67.5312	78.06	104.12
10.25	ELEV	990.98	990.99	991.00	991.01	991.01	991.02	991.02	991.0312	991.11	991.30
12.75	DISCHG	136.10	162.9513	185.89	209.54	231.87	247.3914	263.82	285.71	306.11	320.6315
12.75	ELEV	991.51	991.673	991.80	991.93	992.05	992.124	992.21	992.32	992.42	992.4915
15.25	DISCHG	377.08	593.64	824.45	881.5416	748.58	530.55	420.50	379.9017	355.03	327.63
15.25	ELEV	992.78	993.26	993.53	993.59	993.44	993.19	992.94	992.797	992.67	992.53
17.75	DISCHG	303.84	287.338	255.75	198.05	148.45	111.4019	87.88	70.24	57.25	48.4420
17.75	ELEV	992.41	992.33	992.17	991.87	991.58	991.364	991.18	991.05	990.95	990.88
20.25	DISCHG	43.26	38.94	35.36	32.4621	30.12	28.22	26.70	25.4722	24.47	23.67
20.25	ELEV	990.83	990.79	990.75	990.73	990.70	990.68	990.67	990.664	990.65	990.64
22.75	DISCHG	23.02	22.5023	22.08	21.73	21.46	21.2424	20.89	18.36	17.06	15.7825
22.75	ELEV	990.63	990.633	990.62	990.62	990.62	990.624	990.61	990.58	990.53	990.495
25.25	DISCHG	14.59	13.49	12.47	11.5326	10.66	9.85	9.11	8.4227	7.78	7.19
25.25	ELEV	990.46	990.42	990.39	990.36	990.33	990.31	990.28	990.266	990.24	990.22

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 15.0017 CFS-HRS= 2793.45 ACRE-FT= 230.65

ENDCMP 1

PLATE D-17

EXECUTIVE CONTROL CARD OPERATION COMPUT FROM XSECTN/STRUCT 0/ 1 TO XSECTN/STRUCT 0/ 1
STARTING TIME= 0.00 RAIN DEPTH= 1.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 4 SOIL CONDITION= 3
ALTERNATE NO.= 1 STORM NO.= 1

SUBROUTINE RUNOFF STRUCTURE 1
AREA= 0.28 INPUT RUNOFF CURVE= 83.0 TIME OF CONCENTRATION= 0.35
COMPUTED CURVE NO. = 92.8

100-Y

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
11.03	30.112	(RUNOFF)
15.88	407.074	(RUNOFF)
17.08	122.878	(RUNOFF)
18.47	18.350	(RUNOFF)
19.99	17.989	(RUNOFF)
20.99	18.007	(RUNOFF)
21.99	17.984	(RUNOFF)
22.99	17.980	(RUNOFF)
23.91	18.686	(RUNOFF)

TIME		HYDROGRAPH, TZERO= 3.25				DELTA T= 0.25			DRAINAGE AREA= 0.28		
3.25	DISCHG	0.00	1.00	1.37	1.71	2.03	2.34	2.64	2.92	3.18	3.43
5.75	DISCHG	3.67	3.90	8.53	13.52	15.48	16.99	18.25	19.36	20.36	21.25
8.25	DISCHG	22.05	22.77	23.43	24.02	24.57	25.06	25.52	25.94	26.33	26.66
10.75	DISCHG	28.52	30.09	29.16	28.23	29.77	31.29	60.47	85.50	92.96	96.55
13.25	DISCHG	106.34	114.59	116.96	118.28	132.76	145.24	150.00	152.61	269.06	367.04
15.75	DISCHG	388.80	393.74	273.02	169.35	150.18	146.49	150.11	116.60	115.84	116.93
18.25	DISCHG	66.39	24.23	18.11	18.14	16.46	14.99	16.53	17.97	16.47	15.03
20.75	DISCHG	16.53	18.00	16.46	15.02	16.53	17.97	16.47	15.00	16.54	17.98
23.25	DISCHG	16.48	15.03	16.54	18.00	9.20	1.70	0.29	0.04	0.00	

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 7.70 / 6.8347 CFS-HRS= 1265.93 ACRE-FT= 104.61

87

SUBROUTINE RESVOR STRUCTURE 1
SURFACE ELEVATION= 990.00

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
16.17	320.855	992.50

TIME		HYDROGRAPH, TZERO= 3.25				DELTA T= 0.25			DRAINAGE AREA= 0.28		
3.25	DISCHG	0.00	0.03	0.12	0.23	0.35	0.49	0.64	0.80	0.97	1.15
3.25	ELEV	990.00	990.00	990.00	990.00	990.01	990.01	990.02	990.02	990.03	990.03
5.75	DISCHG	1.33	1.52	1.87	2.55	3.45	4.41	5.41	6.42	7.44	8.45
5.75	ELEV	990.04	990.04	990.05	990.08	990.10	990.13	990.17	990.20	990.23	990.26
8.25	DISCHG	9.45	10.43	11.38	12.31	13.22	14.10	14.94	15.76	16.54	17.29
8.25	ELEV	990.29	990.32	990.35	990.38	990.41	990.44	990.47	990.49	990.52	990.54
10.75	DISCHG	18.07	18.92	20.87	22.38	23.66	24.98	29.01	37.50	47.48	59.00
10.75	ELEV	990.57	990.59	990.61	990.63	990.64	990.65	990.69	990.77	990.87	990.96
13.25	DISCHG	70.17	80.77	89.98	97.26	104.69	113.72	123.62	131.97	155.77	205.22
13.25	ELEV	991.05	991.13	991.20	991.25	991.31	991.38	991.44	991.49	991.63	991.91
15.75	DISCHG	266.41	310.65	310.70	284.15	240.07	207.57	185.84	166.98	151.66	141.02
15.75	ELEV	992.22	992.44	992.48	992.31	992.09	991.92	991.80	991.69	991.60	991.54
18.25	DISCHG	126.12	103.56	81.88	65.10	52.52	44.75	39.16	34.93	31.51	28.47
18.25	ELEV	991.45	991.30	991.14	991.01	990.91	990.84	990.79	990.75	990.72	990.69
20.75	DISCHG	26.02	24.33	22.96	21.57	20.45	19.83	19.33	18.85	18.62	18.52
20.75	ELEV	990.66	990.65	990.63	990.62	990.61	990.60	990.60	990.59	990.58	990.58
23.25	DISCHG	18.42	18.22	18.04	17.98	17.65	16.73	15.54	14.38	13.29	12.29
23.25	ELEV	990.58	990.57	990.56	990.56	990.55	990.52	990.49	990.45	990.41	990.38
25.75	DISCHG	11.36	10.50	9.71	8.97	8.29	7.67	7.09	6.55	6.06	5.60
25.75	ELEV	990.35	990.33	990.30	990.28	990.26	990.24	990.22	990.20	990.19	990.17

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 6.7361 CFS-HRS= 1247.67 ACRE-FT= 103.10

ENDCMP 1

END OF JOB TR20 GGJ

WATCH JOB

PLATE D-18